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ENHANCING CAPACITY FOR LOW EMISSION DEVELOPMENT STRATEGIES (EC-LEDS)/ CLEAN ENERGY PROGRAM

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Low Emission Development Strategy-Industry Sector

September 2016

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ENHANCING CAPACITY FOR LOW EMISSION DEVELOPMENT STRATEGIES (EC-LEDS)/ CLEAN ENERGY PROGRAM

Low Emission Development Strategy- Energy Sector

September, 2016

This report was prepared under the technical assistance provided to the Government of Georgia for development of the Low Emission Development Strategy in the framework of the "Enhancing Capacity for Low Emission Development Strategy" (EC-LEDS) project.

The report presents the Industry Sector chapter of the Low Emission Development Strategy. Its Georgian version was submitted to the industry sub working group for consideration and comments on July 26, 2016. No official written comments have been received on this report from sub-working group by September 27, 2016.

Contents

1. Industry Sector Today 1
2. Low Emission Development Strategy of the Industry Sector for 2030 3
3. Low Emission Development Pathway of the Industry Sector 6

Figures

Fig. 1. Final energy consumption in the industry sector by branches of industry and fuel types (2014) 1
Fig. 2. Final energy consumption and the GHG emissions in energy intensive industrial branches (2014)..... 2
Fig. 3. Expected GHG emissions in the industry and energy generation sectors in case of the BAU and emissions reduction scenarios (2014-2030). 6

Abbreviations and Symbols

PJ	Petajoule (10^{15} Joule)
Gg	Gigagram (10^{9}G=10^{3}T)
GWh	Gigawatt-hour (10^{9} W.h)
MW	Megawatt (10^{6} W)
BAU	Business As Usual
EBRD	European Bank for Reconstruction and Development
BAT	Best Available Technique
CO_2	Carbon dioxide
CH_4	Methane
N_2O	Nitrous oxide
GJ	Gigajoule (10^{9} Joule)
TJ	Terajoule (10^{12} Joule)
NO	Nitrogen monoxide
NO_x	Nitrogen oxides
EC-LEDS	Enhancing Capacity for Low Emission Development Strategies
N_2	Molecular nitrogen
KWh	Kilowatt-hour (10^{3} W.h)

1. Industry Sector Today

As of the data of 2014, industry sector ranks No 2 with 16.9% in sectoral structure of Gross Domestic Product (GDP) of Georgia (the largest share - 17.5% belongs to the trade sector), the share of Buildings Sector being 7.1%. The number of persons employed in industry sector in 2014 was 166.6 thousand people, production was amounted to 8 201.5 million GEL and fixed assets totaled 6 097.6 million GEL.

According to the data obtained from the National Statistics Office, there were 6 684 industrial enterprises[1] registed in Georgia in 2015 including 536 large, 661-medium and 5 487 small sized ones[2]. Most of them are registered in food product, beverage and tobacco sub-sectors.

Industry sector consumed 29.82 PJ energy in 2014, accounting for 18.7% final energy totally used in Georgia. Breakdown of energy consumption by branches and fuel types is given below. Fig. 1.

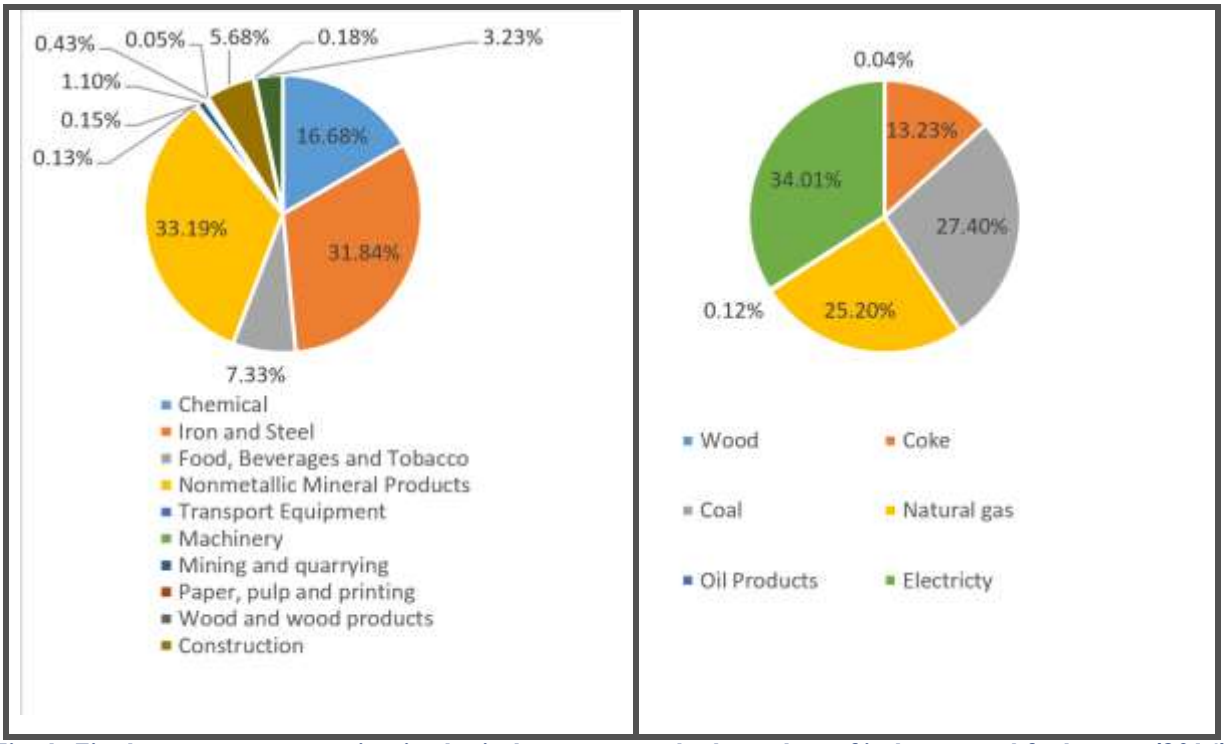


Fig. 1. Final energy consumption in the industry sector by branches of industry and fuel types (2014)

As Fig. 1 shows, electricity remains the most common source of energy (34.01%) of the industry sector followed by coal (27.4%) and natural gas (25.2%). Coke consumption is also high (13.23%). Among industry branches recorded in energy balance of Georgia the greatest amount of energy is consumed by: non-metallic mineral products (33.19%); Chemical and Petrochemical Products (16.68%); Cast iron and steel - 31.84%; Food products, beverages and tobacco (7.33%).

[1] Except for buildings sector.

[2] Large enterprises are businesses where annual average number of employees exceed 100 persons, or annual average turnover is above 1.5 million GEL. Small sized enterprises employ no more than 20 people and annual average turnover is around 0.5 million GEL. Medium-sized enterprises are the rest ones.

Combustion of fossil fuels accounted for 1 638 Gg CO_2 eq. greenhouse gas emissions in the industry sector in 2014 which is 17.4% of total emissions from the energy sector that year. Industry sector emissions in 2014 decreased by 6.42 compared with 1990 (in 1990 greenhouse gas emissions from the industry sector were about 10 530 Gg CO_2 eq.).

As in energy consumption, so in emissions[3] all four branches take the largest share, including non-metallic mineral products (51.67%); Cast iron and steel (26.58%); Chemical and Petrochemical Products (14.55%); Food products, beverages and tobacco (5.22%). (Fig. 2). These braches in total cover 98% of energy consumption and fossil fuel combustion emissions in the industry sector (including indirect emissions from electricity 94%). The main source of emissions in case of non-metallic mineral products is consumption of coal in clinker production, in cast iron and steel - coke consumption in ferroalloys production and in chemical industry-natural gas consumption in ammonia and nitric acid producion. The main source of emissions in food, beverage and tobacco industry is consumption of gas in various industrial processess.

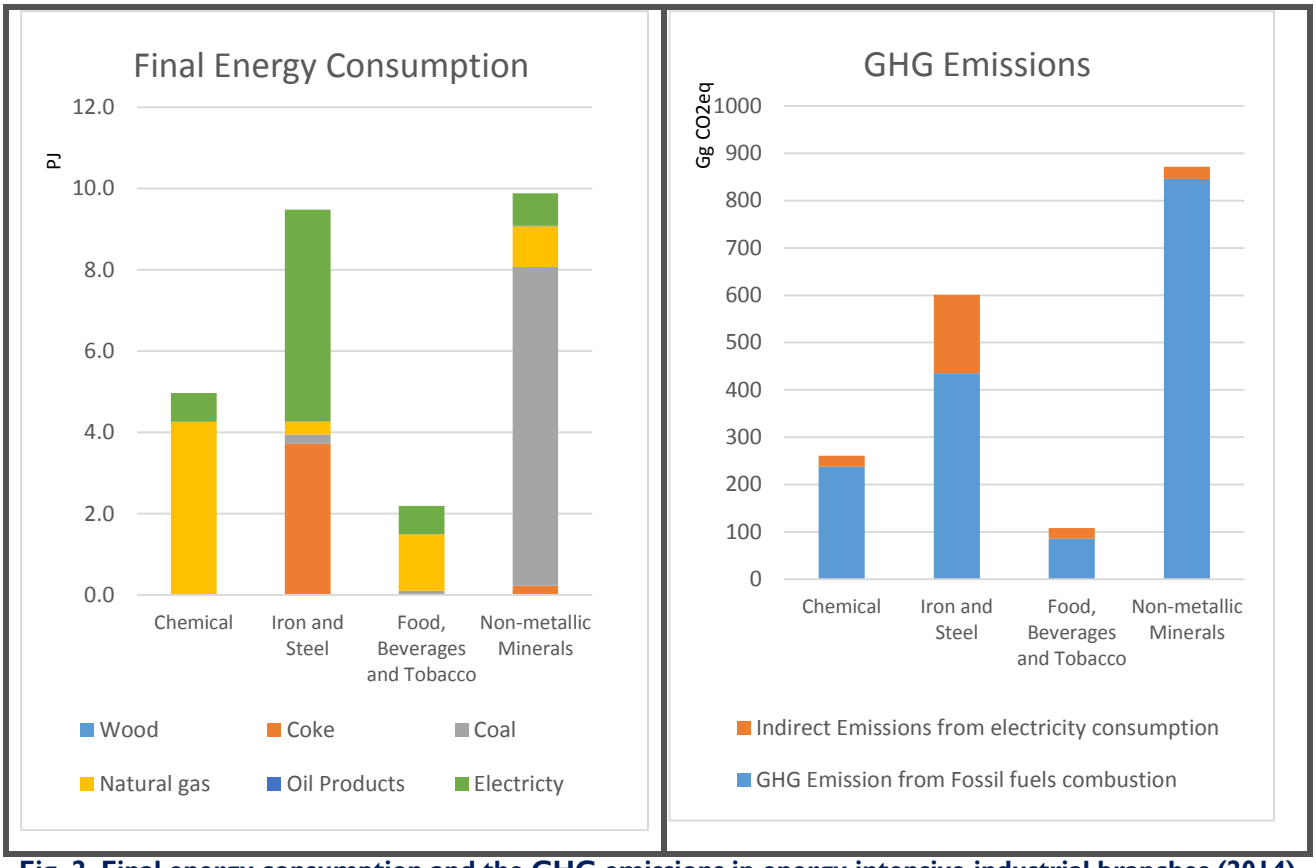


Fig. 2. Final energy consumption and the GHG emissions in energy intensive industrial branches (2014)

Policies of formation of economic growth (including in the industry sector), identification of important directions for economic development and working out proper action plans and programs are the prerogative of the Ministry of Economics and Sustainable Development of Georgia, while the Ministry of Environment and Natural Resources Protection is responsible for state accounting of released harmful substances. Development and implementation of the energy efficiency and renewable energy utilization in all sectors (including the industry) is under responsibility of the Ministry of Energy.

[3] Without taking into account indirect emissions of electricity

During the strategy preparation, questioning of large industrial facilities and comparison of emissions intensity was carried out by the EC-LEDS, which revealed significant differences in energy consumption and emissions intensity in various industrial facilities[4]. It was also revealed that there are three enterprises in Georgia responsible for 71.8% of the GHG emissions from fuel combustion in the industry sector. The share of these enterprises in total energy consumption in the industry sector is 58.8%. These enterprises are "Heidelberg Cement", "Energy Invest" and "Georgian Manganese".

The poll also revealed significant barriers, consideration and elimination of which will be necessary to implement emission reduction measures in the industry sector. In order to remove barriers, clear energy efficiency policy should be intriduced and might be deployed through various political and financial instruments. It is also important the companies to monitor and report achieved progress in energy efficiency as well as to encourage research and development activities in energy efficient technologies. Besides, the government should disseminate information about energy efficiency in industrial facilities as far as possible.

Barriers to emissions reduction measures in the industry sector

- Lack of disposable capital even for such measures, payback periods of which are relatively small;
- Cutting the energy price rather than reduction of energy consumption is considered as net cost reduction method by the industry management;
- Lack of information and knowledge on energy and emissions reduction opportunities and lack of qualified workforce as in enterprises so throughout all the country;
- Absence of clear and effective energy efficient and emissions reduction policy in the State.

2. Low Emission Development Strategy of the Industry Sector for 2030

Industry sector consists of a wide range of industries, technologies and processes, so it would be strategically unjustified to focus only on limited amount of emission reduction measures. Generally, three types of technical measures are considered in the industrial sector:

- To increase energy efficiency in the industrial sector that includes maximum growth of energy efficiency of production via substitution of old technologies and processes by new and efficient ones;
- Fuel substitution, implying to replace currently used high-carbon-containing energy source by cleaner low-carbon-containing substitute;
- Application of Carbon sequestration and storage technologies

The last two directions are usually more expensive than the first option. The first direction, i.e. energy efficient measures is profitable for enterprises, having relatively short payback period of investment. There are less profitable measures as well, with longer payback period. Energy efficient measure are divided into two types based on spreading and identification possibilities:

1. Characteristic measure for specific industrial processes, identification and evaluation of economic benefits of which require detailed energy audit;

[4] For details see the report "Industry Sector Overview" Sustainable Development Centre "Remissia" EC-LEDS project, 2016

2. Relatively general measures that could be beneficial for wide range of enterprises, e.g. energy efficient motors (el. Motors with frequency regulators), efficient cooling system etc. This is true without prior energy audit.

Both types of measures should be encouraged in Georgia. In case of the first measure, it is necessary to identify them mainly in large, energy-intensive enterprises. It is also important to enable medium and small enterprises as well to conduct energy audit by availability of qualified personnel and possibility of using financial instruments in order to determine specific measures for the enterprise. As for the second type of measures, they may be effective by introducing standards or special programs and they can make a lot of savings in many different types of enterprises (both in large organizations and SME's).

The above mentioned measures are of technological profile, identification and implementation of which additionally need political instruments and supporting measures in order to achieve reduction of relatively large-scale emissions in the industry sector. These mechanisms determine state policy of emissions reduction in this sector.

The following types of policy tools and supporting measures are approved worldwide for reduction of emissions in the industry sector:

- Mandatory measures, such as establishment of a cap on energy consumption and/or emissions and demand mandatory energy audits etc.;
- As already mentioned, even economically beneficial measures cannot be implemented due to various barriers (see insertion 1). Therefore, it is important for such types of measures to overcome investment, knowledge and technologies related barriers.
- Measures that are more expensive can be implemented through imposing payments for emissions or energy consumption, subsidies or other economic or fiscal policies.
- Supporting of energy efficient/low-carbon technology research, development and demonstration to create new, climate change mitigation technologies or transfer yet foreign ones.

Over a period of 8 years, emphasis should be laid only upon cost-effective measures, ensuring economic savings for the industry sector. Therefore, there is a concentration on such supporting activities, which are directed to remove or relieve barriers and include the following measures:

- To conduct energy audits aimed to determine energy consumption and emissions reduction measures in industrial facilities and rate their economic efficiency;
- Training and awareness raising activities for representatives of industrial facilities to make them see how energy efficiency measures can reduce production expenses and cost;
- Development of such financial mechanisms that will make primary investment capital available for industrial facilities. This might be cheap loans of targeted energy efficiency, energy efficiency fund etc.;
- Mass promotion of energy efficient technologies (e.g. engines, cooling systems, boilers etc.) through development of special programs and introducing legislative requirements.

At the same time, it will be important to build energy consumption/emissions measures/monitoring systems and use obtained results in industrial facilities to determine auditing priorities and monitor energy consumption and emissions in this sector.

In addition to these measures, it will be necessary for large enterprises to integrate binding mechanisms of regulation of emissions (e.g. to conduct mandatory energy audit, or set upper limit of emissions) or to sign voluntary agreement aiming to encourage facilities in case of implementing energy efficient measures (e.g. reduction of any tax). Such measures need large-scale consultations with the industry sector though, these consultations are planned to be carried out, and a legislative portfolio will be prepared before 2025.

Low emission development strategy of the industry sector considers period until 2025 as a preparatory period for industrial facilities to commence binding mechanisms of the industry sector from 2025, requiring energy and emissions reduction measures on legislative level.

Low Emission Development Strategy of the Industry Sector

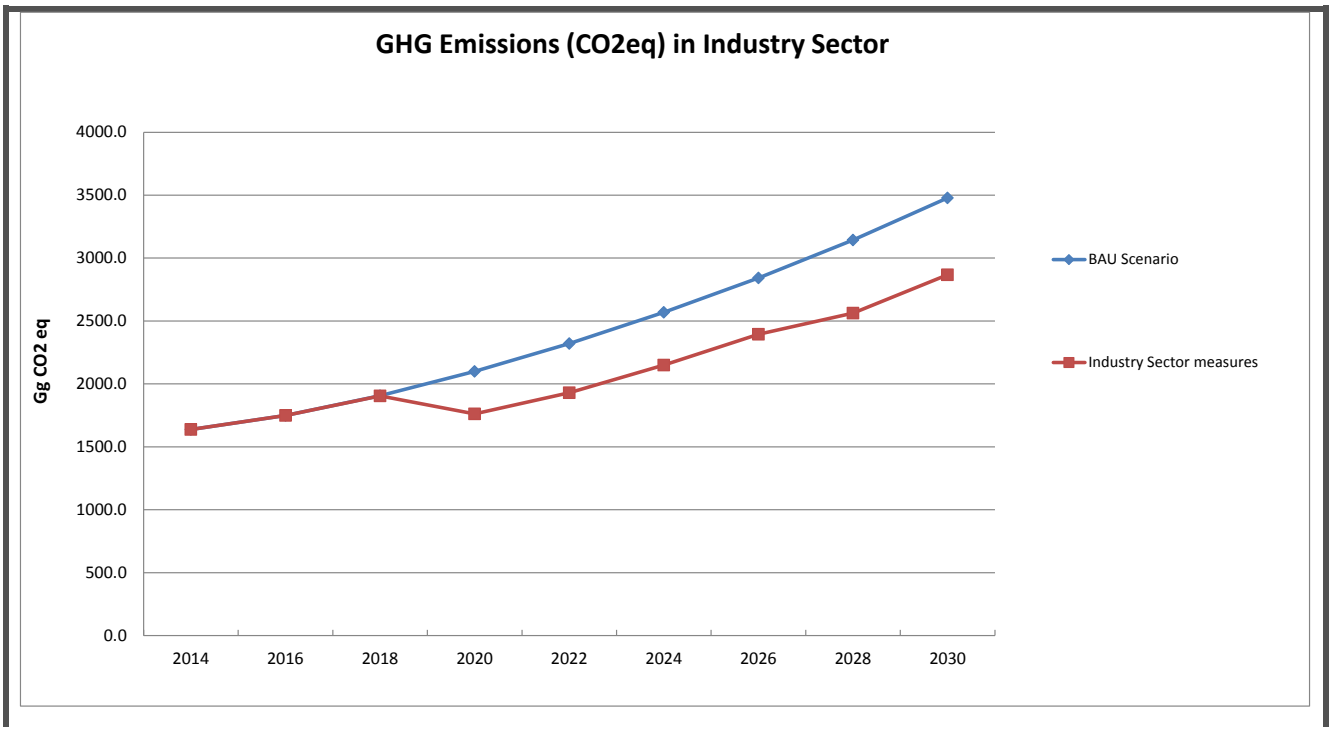
Short-term (2017-2025):

- To determine shape of the legislative regulation of the GHG emissions (or rates of energy consumption) and prepare relevant legislative portfolio based on a dialogue with the industry sector representatives;
- To develop financial mechanisms to promote emissions reduction measures in the industry sector (including audits, etc.) and organize state monitoring on financial aids;
- To implement flexible monitoring system on energy consumption and the GHG emissions;
- To deploy permit systems for industrial emissions;
- To study the possibility of introducing the best international practices in the industry sector

Long-term (2026-2030):

- To implement/commence legislative regulations of the GHG emissions in the industry sector
- To prepare short-term state program/plans to reduce annual amount of emissions from existing facilities (it includes both the GHG emissions and other industrial gases)

The following Chapter considers the GHG emission reduction measures, which may save 641.3 Gg CO_2eq GHG emissions from burnt fuel per year by 2030. 607.6 Gg is saved in the industry sector, representing 17.5% of expected emissions by 2030. Additional 33.8 Gg emissions are saved in energy generation sector caused by reduction of energy consumption in the industry sector and representing 1.5% of expected emissions in energy generation sector by 2030. Fig.3 shows expected growth of emissions in the industry and energy generation sectors. One of them is baseline growth in case of the BAU scenario, and the second-in case of implementation of measures planned for the industry sector.



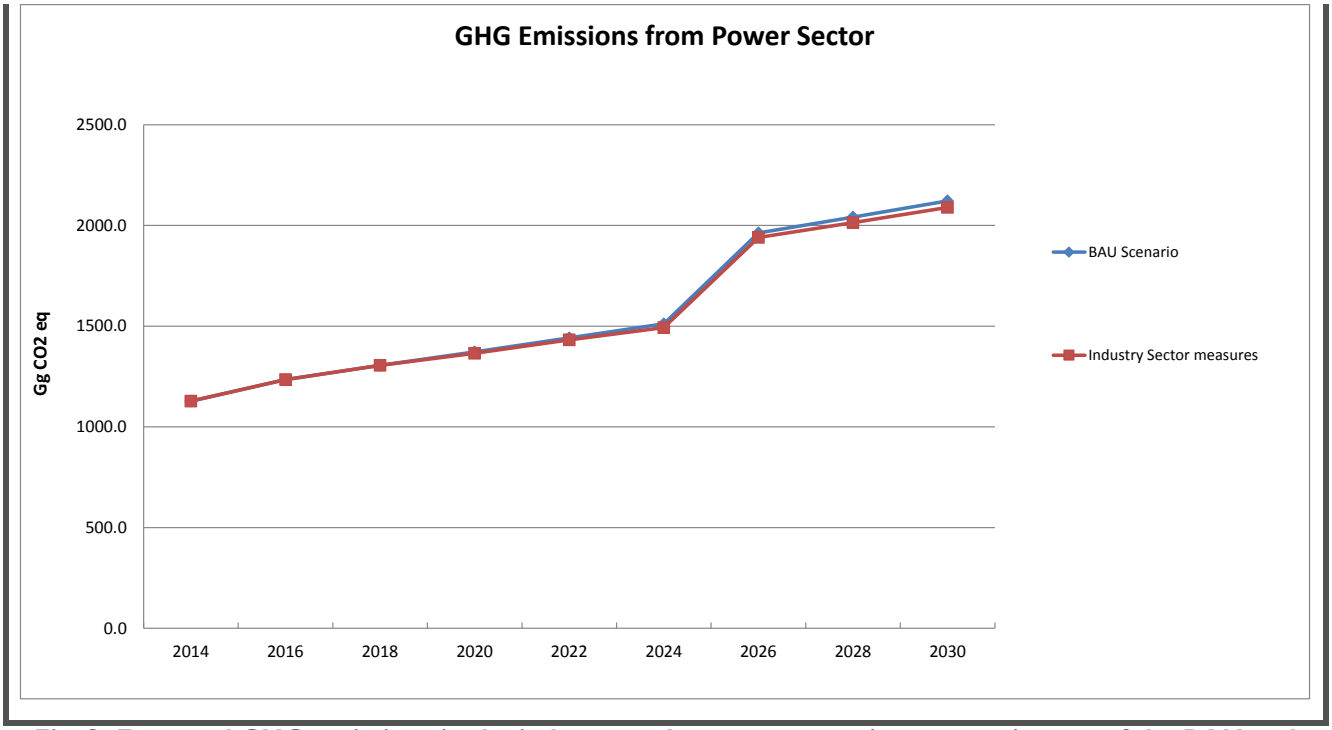


Fig. 3. Expected GHG emissions in the industry and energy generation sectors in case of the BAU and emissions reduction scenarios (2014-2030).

Following the implemented measures from the industry sector, primary energy compared to the BAU in 2030 is decreasing by 2.3%, final energy – by 2.7%, import of energy carriers by 1.7%. Energy generation is decreasing by 455GW (1.4%) that is why 90 MW less power plant installed capacity will be required compared to the BAU.

Significant reduction of emissions in emissions reduction scenario in 2020 is caused by changing the method of clinker production from wet to dry (see measure IMEA1) in Heidelberg Cement Kaspi plant. This measure has the strongest effect on reduction of emissions in the industry sector.

3. Low Emission Development Pathway of the Industry Sector

This chapter discusses low-emission development measures in the industry sector. The measures include as policy instruments planned to be implemented in the industry sector, as well as individual technical measures resulted from the mentioned policy instruments and causing real reduction of energy consumption and emissions.

Policy Instruments:

Measure to be implemented	IPOL1: Determination of emissions regulation types from large, energy intensive industries of Georgia
Type of the Measure	Information/legislative
Implementing body	Ministry of Economy and Sustainable Development of Georgia, Ministry of Environment and Natural Resources protection of Georgia
Implementation period	2017-2023 (dialogue and research)2024-2025 (preparation of the legal base), 2026-2030 (Enactment and implementation)

GHG	CO_2
Reduction of emissions by 2030	In order to avoid double counting of reduced emissions, emissions reduction values are not calculated for these measures. They are calculated for specific technological measures. This action is important/necessary measure to achieve reduction of emissions in particular technical measures
Description of the measure	The measure considers determination of such legal mechanisms for large energy intensive industrial sectors of Georgia, which will regulate the GHG emissions from such facilities. Possible options that are being considered are as follows: • Conduction of mandatory energy audits and development of the energy management system (this measure may come into force before 2025 in accordance with the EU energy efficiency directive requirements); • Execution of a voluntary agreement and implementation of appropriate fiscal policy (taxes on energy consumption, reduction of the income tax etc.) • Determination of upper limit for energy consumption and/or emitted emissions • Inclusion of GHG emissions in environmental permit system and or any combination of these measures While regulating emissions for large facilities of the industrial sector, it is important, such measures to be acceptable for both the country and these industrial facilities. Therefore, it will be essential to involve the enterprise representatives into policy development process. First of all, dialogues and proper consultations with the industry are needed together with relevant discussions. Thus the measure includes the several stages: 2017-2023 – surveys and dialogues with the industry to plan state policy of emissions reduction in the industry sector. At the same time, observations are carried out on promotional activities and their effects. 2024 – 2025 – Preparation of appropriate legislative framework and determination of emissions reduction target indicators. 2026-2030 – Enactment and implementation of worked out mechanisms of regulating the emissions. In addition to political/legal regulation mechanisms, carrying out of a number of subsidiary measures (financial, awareness raising, etc.) directed to remove barriers of energy efficiency activities will be necessary. The measures are listed below.
Estimated cost	Expenses of the measure by 2025 mainly include detailed analysis of the industry sector (approximately 300 000 USD), organization of workshops (about 100 000) and technical assistance to develop the legislative framework (200 000 USD approximately), a total of 600 000 USD. Since 2016, the expenses will be covered by industrial facilities and reflected in appropriate individual technological measures. The state would have to deal with annual monitoring expenses, about 100 000 USD a year (3 qualified personnel).

Assumptions and estimates	This is one of the important/necessary measures to achieve reduction of emissions in individual technological measures.

Measure to be implemented	IPOL2: Financial instruments and their monitoring to carry out emissions reduction activities in the industry sector
Type of the mesure	Financial
Implementing body	Ministry of Energy
Implementation period	2017-2030
GHG	CO_2
Reduction of emissions by 2030	In order to avoid double counting of reduced emissions, emissions reduction values are not calculated for these measures. They are calculated for specific technological measures. This action is important/necessary measure to achieve reduction of emissions in particular technical measures.
Description of the Measure	This measure is aimed to eliminate initial investment capital scarcity/insufficiency barrier and considers the programs providing financial and technical support for industrial facilities to carry out emissions reduction measures. Financial instruments may be the Energy efficiency fund, which will partially finance energy efficient measures or/and energy audits, or such programs, as the EBRD Energy Credit. It is noteworthy to mention that at present similar programs are going on but they are not coordinated, they are not widespread, and their results are not monitored due to which their actual effect is not known. Thus, this measure considers the study of energy credit or similar credit lines (in order to assess the final user's real interest rate and its feasibility), as well as, from the government's side, conducting continuous monitoring of the relevant funds and projects to evaluate the savings of the generated energy and emissions resulted from the allocated funds and the implemented projects.
Estimated Cost	Expenses of the measure cover a survey of the existing financial mechanisms and recommendations (approximately, 200 000 USD), which will reveal forms of financial mechanisms and the amount of funds to be allocated under these mechanisms.
Assumptions and Assessments	This measure is an important/essential activity to carry out emissions reduction during implementing individual measures.

Measure to be Implemented	IPOL3: Inventory of energy and the GHG at the enterprise level and identifying energy consumption and the GHG emissions guideline for each field/sector

Type of the Measure	Legislative/Information
The Implementing Body	Ministry of Environment and Natural Resources Protection of Georgia
Implementation years	2017-2018
GHG	---
Reduction of Emissions by 2030	Has not been calculated.
Description of the Measure	The measure covers collection of information from the industrial facilities about their energy consumption and emissions emitted from them, and using this information for calculation of specific energy consumption and emissions, and for comparison with the examples of international good practices, or those existing in Georgia. In compliance with the Law of Georgia "on Ambient Air Protection" and "Technical Regulations for Self-monitoring and Reporting of Emissions of Harmful Substances from Stationary Sources of Pollution" (#413, ordinance of the Government of Georgia, as of December 31, 2013), state registration of emission of harmful substances into the ambient air from stationary sources of pollution is conducted by the Ministry of Environment and Natural Resources Protection of Georgia. State registration of emission of harmful substances is conducted through filling-in the state registration forms of emission of harmful substances which are filled-in by the activity performers at the end of the fiscal year before February 15 and submitted for approval to the state sub-department of the Ministry of Environment and Natural Resources Protection of Georgia – Department of Environmental Supervision and its corresponding territorial bodies besides Ajara, where the said forms are submitted to the board of Environment and Natural Resources Protection of Autonomous Republic of Ajara. Further these forms are submitted to the Ministry of Environment and Natural Resources Protection. It should be noted that the form contains information about energy consumption and emission of carbon dioxide. In order to facilitate the entrepreneurs' reporting to the Ministry, from 2017 an electronic reporting system will be adopted. Accordingly, the entrepreneur should enter the corresponding data for state registration form into the electronic system on the address: www.emoe.gov.ge (the changes about submitting the data in electronic version is included in the corresponding normative act). The measure also covers the improvement of the form in respect of registration of the GHG emissions and using the mentioned database in the industry sector to identify the energy consumption and emissions analysis and emissions reduction policy.
Estimated Cost	The web-page www.emoe.gov.ge for the Ministry of Environment and

	Natural Resources Protection is performed by the Ministry of Finance of Georgia. The expansion and improvement of the web-page may also be performed under the support of the Ministry of Finance of Georgia.
Assumptions and Assessments	

Measure to be Implemented	IPOL4: Study of possibility of introducing energy audit and Best Available Techniques (BAT) practice
Type of the Measure	Capacity building
The Implementing Body	
Implementation years	2017-2023
GHG	CO_2, CH_4, N_2O
Reduction of Emissions by 2030	To avoid the double counting, the emissions reduction values have not been calculated for this measure, however it was calculated for specific technologic measure. It should be considered that this activity is an important/essential measure to reach the emissions reduction in some technological measures.
Description of the Measure	Best Available Technique (BAT) is defined by the directive of EU industrial emissions and implies the most effective and developed method which may be used in practice to identify the marginal rate or some other type of permission terms in order to either completely be reduced/excluded the emissions, and where this latter can't be practically implemented, to carry out the utmost reduction of their impact, and their impact on environment. a) "Method/Technique" implies both the used technology and the installation design, construction, operation and rendering harmless; b) "Available" Method/Technique implies availability of using this technique in the corresponding industrial sector in case of existence of the corresponding economic and technical conditions considering the cost effectiveness; c) "Best" implies such a Method/Technique which is most effective in terms of environment protection. The measure covers preparing and training experts in industrial sector to conduct energy audit and introduce the Best Available Technique and assessing the potential of study of introducing this technique in the industrial facilities (conducting such studies and introduction of Best Available Technique is also required in the frames of EU - Georgia Association Agreement).
Estimated Cost	The measure covers the expenses of preparing and certifying energy auditors, as well as the expenses related to preparing relevant guideline

	documents (approximately, 600 000 USD) and the expenses of conducting the energy audit themselves, which partially or completely will be covered by the industrial facilities. The audit expenses of the industrial facilities depend on the complexity of the industrial facilities themselves and the quantities of the equipment/processes, while in the developed countries it varies between 10 000USD and several hundreds of dollars.
Assumptions and Assessments	----------

Individual Technological Measures:

Measure to be Implemented	IMEA1: The transfer of clinker production from wet method to dry method in Kaspi and Rustavi Heidelberg Cement Plants.
Type of the Measure	Technological
The Implementing Body	Heidelberg Cement
Implementation years	2020 for Kaspi Plant, and 2028 – for Rustavi Plant.
GHG	CO_2
Reduction of Emissions by 2030	413 Gg
Description of the Measure	Producing non-metallic mineral products in Georgia is characterized with the highest emissions, and in this branch itself the most part of emissions comes on clinker production in Heidelberg Cement plants. Heidelberg Cement produces clinker in three plants. The largest plant is located in Kaspi, and two of them in Rustavi. In one of the Rustavi Plants dry process of clinker production is used while in another plant of Rustavi and in Kaspi Plant – wet process is implemented. In the wet process it is needed to evaporate additional amount of water (30-50%) compared with dry method, and this time the heat energy expenditure is much higher than it is during the use of dry method. In Rustavi plant with dry method of clinker production, intensity of coal in 2014 was 2.34GJ/ton, in Rustavi plant with wet method of clinker production -4.55GJ/ton, and in Kaspi Plant – 5.82GJ/ton. The measure implies transferring Kaspi and Rustavi Plants from wet method to dry one of clinker production.
Estimated Cost	The plant does not give any information on the cost.
Assumptions and	It was assumed that by 2020 Kaspi Plant will be completely transferred to

Assessments	dry method fabrication, and its annual production will be increased up to 1.1million tons of clinker[5], and in 2028 Rustavi wet Plant will also be transferred to dry method and the production will be increased up to maximum level – annually 475 thousand tons of clinker. According to the assumption, transferring to dry method of production the intensity of coal consumption will be reduced in both plants by 50%. Consequently, in 2030 in total will be saved 4.3PJ coal.

Measure to be Implemented	IMEA2: Other energy efficiency measures in producing non-metallic mineral products
Type of the Measure	Technological
The Implementing Body	Industrial Facilities ("Heidelberg Cement")
Implementation years	2017-2030
GHG	CO_2
Reduction of Emissions by 2030	285tons (only additional measure of Heidelberg Cement)
Description of the Measure	Besides clinker production, manufacturing non-metallic mineral products also includes brick production, lime production, etc. Apart from the measures listed in IMEA1, possibilities of energy reduction may also be found in cement production. For example, in Heidelberg Cement 5.1TJ natural gas may be saved per year in case of secondary consumption of energy generated during clinker cooling process on drying the raw material before grinding it and in grinding mills of raw material.
Estimated Cost	Will be identified through the energy audit.
Assumptions and Assessments	In this measure only one single activity is considered to be implemented in Heidelberg Cement. It is required to conduct additional studies in other plants of the same category to identify the emissions saving potential.

Measure to be Implemented	IMEA3: Energy efficiency measures in chemical industry
Type of the Measure	Technological
The Implementing Body	Industrial Facilities ("Rustavi Azot")
Implementation years	2017-2030

[1]nformation from the plant

<table>
<tr><td>GHG</td><td>CO_2</td></tr>
<tr><td>Reduction of Emissions by 2030</td><td>In total, 37.5Gg, of which 24.2Gg is produced by reduction of gas consumption in the plant itself, and 13.3Gg is saved in the electricity generation sector as a result of reduction of electric energy consumption.</td></tr>
<tr><td>Description of the Measure</td><td>This measure implies implementation of different types of measures at “Rustavi Azot” Plant. The measures will be implemented both under the initiative of the industrial facility itself (“Rustavi Azot”), and using the above described political instruments.

In the process of preparation of this strategy, under EC-LEDS project the survey was carried out at “Rustavi Azot” Plant representing the only largest energy consumer in this industrial sector (chemical industry). According to the information of the plant, a number of measures should be implemented at the plant, which may save the consumed energy and the GHG emissions.

These are:

• Arranging and using the energy management system
• Rehabilitation of steam distribution system
• Using technological process heat
• Using high pressure steam to generate electric energy
• Modernization of compressors existing in ammonia production
• Substitution of burners in ammonia production
• Purification of gases containing NO-NOx to receive N_2
• Using low potential steam to receive a coolant.
According to the assessment of the plant representatives, as a result of implementation of the measure 12million m^3 gas and 170 GWh electric energy may be saved, representing 10% of the gas consumed from the grid at the plant and 60% of the consumed energy (actually, 40% of electric energy is saved, and the rest of energy is produced locally by using high pressure steam in electric generator)</td></tr>
<tr><td>Estimated Cost</td><td>The estimated cost of implementation of the above-listed measures at “Rustavi Azot” is:

<table><tr><td>Rehabilitation of steam distribution system</td><td>275 000 USD (250 000 EUR)</td></tr><tr><td>Using technological process heat</td><td>2.2 million USD (2million EUR)</td></tr><tr><td>Using high pressure steam to generate electric energy</td><td>5623783 USD</td></tr><tr><td>Modernization of compressors existing in ammonia production</td><td>9-10 Million USD</td></tr><tr><td>Substitution of burners</td><td>980000 USD per unit</td></tr><tr><td>Purification of gases containing NO-NOx to receive N_2</td><td>To be defined</td></tr></table></td></tr>
</table>

	Using low potential steam to produce a coolant	2320280USD
Assumptions and Assessments	An assumption was made that all the enumerated measures (or some other equivalent measures) will be implemented in "Rustavi Azot" Plant until 2030. The amount of the energy reduced by the measures has been calculated by the plant experts[6], and emissions reduction has been calculated using the MARKAL-Georgia model.	

Measure to be Implemented	IMEA5: Energy efficiency measures in ferroalloys production
Type of the Measure	Technological
The Implementing Body	Industrial facilities which produce ferroalloys in Georgia
Implementation years	2020-2030
GHG	CO_2
Reduction of Emissions by 2030	In total, 146 thousand tons, of which 137 thousand tons is produced by reducing consumption of coke in the plant itself, and 9 thousand tons are saved in the energy generation sector as a result of reduction of energy consumption at the plants.
Description of the Measure	The measure implies implementation of different types of measures in ferroalloys production. The measures will be implemented both under the initiative of the industrial facilities themselves and using the above described political instruments. In Iron and steel production, about 88% of energy consumption comes on ferroalloys production (about 95% of coke consumption and 85% of electric energy consumption). In Georgia Silicomanganese (90% of the produced ferroalloys) is mostly produced. Under EC-LEDS project a survey of four plants from this category has been conducted, as a result of which it was identified that the intensity of both coke and energy consumption per production of one ton of product is higher than the internationally accepted norms. Particularly, the average intensity of coke consumption varies within the frames of 500-550kg coke/ kg of product, and electric energy intensity – 5000-5200KWh/ton of product. International norms do not exceed 400kg coke per kg of product and 4800KWh electric energy per ton of product[7], that allows reducing consumption of coke by 20-25% and the electric energy – by 4-8%.

[6] "Report on "The planned and potential measures for reduction of energy consumption at "Rustavi Azot" Plant. Sustainable Development Center "Remissia", 2016.

[7] Olsen S.E., Tanstad M., and Lindstad T., "Production of Manganese Ferroalloys", Tapir, Trondheim, 2007.

Estimated Cost	Will be identified through the energy audit.
Assumptions and Assessments	An assumption was made that until 2030 the intensity of coke consumption will be reduced by 20% in ferroalloys production and electric energy consumption intensity – by 5%. Values of emissions reduction have been calculated using MARKAL-Georgia model.

Measure to be Implemented	IMEA6: Energy efficiency measures in iron and steel industry
Type of the Measure	Technological
The Implementing Body	Reinforcement of producing industrial facilities
Implementation years	2017-2030
GHG	CO_2
Reduction of Emissions by 2030	10 Gg
Description of the Measure	The measure implies implementation of different types of measures in iron and steel industry (except production of ferroalloys). The measures will be implemented both under the initiative of the industrial facilities themselves and using the above described political instruments. In iron and steel industry, the largest part of the gas is consumed for reinforcement production where it is possible to reduce gas consumption. The below-given possibilities of gas reduction in reinforcement production have been identified by EC-LEDS project experts. During rolling reinforcement the castings are heated in methodical furnaces at the expense of natural gas burning at temperature up to 1250^0C. Considering this, it is very important to provide effective operation of the furnace. In such furnaces, it is urgent to use inner regeneration that means using the energy of the burnt gases for heating the needed air. This measure will save about 10% of natural gas. As well, in the methodical furnaces the operation of gas burners may be performed in automatic mode in order to provide the required capacity for heating process, as well as, full burning of natural gas. In this case the saving may make up 15-20%.
Estimated Cost	
Assumptions and Assessments	According to the measure saving, an assumption was made that in the industrial facilities of this category gas consumption will be reduced by about 15%. The values of emissions reduction have been calculated under

	the MARKAL-Georgia model.

Measure to be Implemented	IMEA7: Energy efficiency measures in food products, beverages and tobacco industry
Type of the Measure	Technological
The Implementing Body	Food products, beverages and tobacco producing industrial facilities
Implementation years	2017-2030
GHG	CO_2
Reduction of Emissions by 2030	23 Gg
Description of the Measure	The measure implies implementation of different types of activities in food products, beverages and tobacco industry. The measures will be implemented both under the initiative of the industrial facilities themselves and in result of enactment of the above described political instruments. To prepare these measures, under the EC-LEDS project a survey of several enterprises of this category was conducted, in which several possibilities were identified of energy efficiency improvement. These are: • Substitution of the outdated steam boilers, or installation of modern burners on steam boilers at Agara Sugar Plant, which may save from 11 up to 27% of the consumed heating energy (gas); • Returning the steam condensate and its consumption. This measure has been implemented at Kobuleti Fruit Juice Concentrate Plant as a result of which 25% of the gas consumed by the steam boiler was saved; • At the Dairy Plants the combined consumption of heat and cold on the basis of heat pump also significantly saves the natural gas consumed by the plant. Namely, per 1KWh electric energy 2.5-3KWh equivalent natural gas is saved.
Estimated Cost	Will be identified through the energy audit.
Assumptions and Assessments	During assessment of the measure, an assumption was made that the implemented political and financial instruments will cause implementation of energy efficiency measures in the enterprises of this sector, which, in total, are responsible for 30% of energy consumed by the sector. The values of emissions reduction have been calculated with the help of the MARKAL-Georgia model.

Measure to be Implemented	IMEA8: Efficient motors
Type of the Measure	Legislative/Technological
The Implementing Body	Ministry of Energy of Georgia
Implementation years	2025
GHG	CO_2
Reduction of Emissions by 2030	11 Gg
Description of the Measure	The measure implies implementation of eco-design requirements for electric motors (Regulation (EC) No 640/2009), which should be implemented during six years after enactment of EU-Georgia Association Agreement; The effect of the measure is also strengthened with existence of the financial mechanisms, which should promote equipping the motors with frequency regulators.
Estimated Cost	Legislative measure covers preparation of the appropriate legal changes to implement mentioned regulation (approximately 100 000USD). It will also include the investment expenses for modernization of energy efficient motors, which fully or partially will be covered by the enterprises themselves.
Assumptions and Assessments	For the electric motors, the above said regulation requires after 2018 the engines existing and set out at the market to be equipped with frequency regulators. The frequency regulator increases the efficiency of the engine by about 15%. To assess the measure, an assumption was made that by 2030 50% of the motors existing in the industrial sector will be substituted and equipped with frequency regulators.